DRINKING WATER SURVEILLANCE PROGRAM

KINGSTON WATER TREATMENT PLANT

ANNUAL REPORT 1990

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EXECUTIVE SUMMARY

DRINKING WATER SURVEILLANCE PROGRAM

KINGSTON WATER TREATMENT PLANT
1990 ANNUAL REPORT

The Drinking Water Surveillance Program (DWSP) for Ontario is a monitoring program providing immediate, reliable, current information on drinking water quality. The DWSP officially began in April 1986 and is designed to eventually include all municipal supplies in Ontario. In 1990, 76 systems were being monitored.

The Kingston water treatment plant is a conventional treatment plant which treats water from Lake Ontario. The process consists of coagulation, flocculation, sedimentation, filtration and disinfection. Sulphur dioxide is used to remove the excess chlorine from the disinfection process. This plant has a rated capacity of 118.0 x 1000 m^3/day. The Kingston water treatment plant serves a population of approximately 80,500.

Water at the plant and at one location in the distribution system was sampled for the presence of approximately 180 parameters. Parameters were divided into the following groups: bacteriological, inorganic and physical (laboratory chemistry, field chemistry and metals), and organic (chloroaromatics, chlorophenols, pesticides and PCB, phenolics, polyaromatic hydrocarbons, specific pesticides and volatiles). Samples were analyzed for specific pesticides and chlorophenols twice a year in the spring and fall.

Table A is a summary of all results by group.

No known health related guidelines were exceeded.

The Kingston water treatment plant, for the sample year 1990, produced good quality water and this was maintained in the distribution system.

TABLE A

DRINKING WATER SURVEILLANCE PROGRAM KINGSTON WTP

SUMMARY TABLE BY SCAN

A POSITIVE VALUE DENOTES THAT THE RESULT IS GREATER THAN THE STATISTICAL LIMIT OF DETECTION AND IS QUANTIFIABLE

A '.' INDICATES THAT NO SAMPLE WAS TAKEN

SCAN	SITE RAW TESTS	RAW POSITIVE	RAW %POSITIVE	TREATED TESTS	TREATED POSITIVE	TREATED %POSITIVE	SITE 2 TESTS	SITE 2 POSITIVE	SITE 2 %POSITIVE
BACTERIOLOGICAL	18	12	66	6	0	0	6	1	16
CHEMISTRY (FLD)	18	18	100	36	36	100	50	40	80
CHEMISTRY (LAB)	132	108	81	132	96	72	228	205	89
METALS	144	56	38	144	40	27	276	118	42
CHLOROAROMATICS	70	0	0	70	0	0	70	0	0
CHLOROPHENOLS	12	0	0	12	0	0	.	.	.
PAH	85	0	0	85	0	0	17	0	0
PESTICIDES & PCB	184	1	0	184	0	0	106	0	0
PHENOLICS	6	1	16	6	0	0	.	.	.
SPECIFIC PESTICIDES	54	0	0	54	0	0	5	0	0
VOLATILES	145	0	0	174	24	13	174	24	13
TOTAL	868	196		903	196		932	388	

DRINKING WATER SURVEILLANCE PROGRAM

KINGSTON WATER TREATMENT PLANT
1990 ANNUAL REPORT

INTRODUCTION

The Drinking Water Surveillance Program (DWSP) for Ontario is a monitoring program providing immediate, reliable, current information on drinking water quality. The DWSP officially began in April 1986 and is designed to eventually include all municipal supplies in Ontario. In 1990, 76 systems were being monitored.

Appendix A has a full description of the DWSP.

The DWSP was initiated for the Kingston water treatment plant in February of 1987. Previous annual reports have been published for 1987, 1988 and 1989.

PLANT DESCRIPTION

The Kingston water treatment plant is a conventional treatment plant which treats water from Lake Ontario. The process consists of coagulation, flocculation, sedimentation, filtration and disinfection. Sulphur dioxide is added to remove the excess chlorine from the disinfection process. This plant has a rated capacity of 118.0 x 1000 m^3/day. The Kingston water treatment plant serves a population of approximately 80,500.

The sample day flows ranged from 50.0 x 1000 m^3/day to 60.0 x 1000 m^3/day.

General plant information is presented in Table 1 and a schematic of plant processes, chemical addition points and sampling locations in Figure 1.

SAMPLING AND ANALYSES

Sample lines in the plant were flushed prior to sampling to ensure that the water obtained was indicative of its origin and not residual water standing in the sample line.

At all distribution system locations two types of samples were obtained, a standing and a free flow. The standing sample consisted of water that had been in the household plumbing and service connection for a minimum of six hours. These samples were used to make an assessment of the change in the levels of inorganic compounds and metals, due to leaching from, or deposition on, the

plumbing system. The only analyses carried out on the standing samples therefore, were General Chemistry and Metals. The free flow sample represented fresh water from the distribution system main, since the sample tap was flushed for five minutes prior to sampling.

Attempts were made to capture the same block of water at each sampling point by taking the retention time into consideration. Retention time was calculated by dividing the volume of water between two sampling points by sample day flow. For example, if it was determined that retention time within the plant was five hours, then there would be a five hour interval between the raw and treated sampling. Similarly, if it was estimated that it took approximately one day for the water to travel from the plant to the distribution system site, this site would be sampled one day after the treated water from the plant.

Stringent DWSP sampling protocols were followed to ensure that all samples were taken in a uniform manner (see Appendix B).

Plant operating personnel routinely analyze parameters for process control (Table 2).

Water at the plant and at one location in the distribution system was sampled for the presence of approximately 180 parameters. Parameters were divided into the following groups: bacteriological, inorganic and physical (laboratory chemistry, field chemistry and metals), and organic (chloroaromatics, chlorophenols, pesticides and PCB, phenolics, polyaromatic hydrocarbons, specific pesticides and volatiles). Samples were analyzed for specific pesticides and chlorophenols twice a year in the spring and fall. Laboratory analyses were conducted at the Ministry of the Environment facilities in Rexdale, Ontario.

RESULTS

Field measurements were recorded on the day of sampling and were entered onto the DWSP database as submitted by plant personnel.

Table 3 contains information on delay time between raw and treated water sampling, flow rate, and treatment chemical dosages.

Table 4 is a summary break-down of the number of water samples analyzed by parameter and by water type. The number of times that a positive or trace result was detected is also reported.

Positive denotes that the result is greater than the statistical limit of detection established by the Ministry of the Environment laboratory staff and is quantifiable. Trace (<T) denotes that the level measured is greater than the lowest value detectable by the method but lies so close to the detection limit that it cannot be

confidently quantified.

Table 5 presents the results for parameters detected on at least one occasion.

Table 6 lists all parameters analyzed in the DWSP.

Associated guidelines and detection limits are also supplied on Tables 5 and 6. Parameters are listed alphabetically within each scan.

DISCUSSION

GENERAL

Water quality was judged by comparison with the Ontario Drinking Water Objectives publication (ODWOs). When an Ontario Drinking Water Objective (ODWO) was not available, guidelines/limits from other agencies were used. These guidelines were obtained from the Parameter Listing System database.

IN THIS REPORT, DISCUSSION IS LIMITED TO:

- **THE TREATED AND DISTRIBUTED WATER;**
- **ONLY THOSE PARAMETERS WITH CONCENTRATIONS ABOVE GUIDELINE VALUES; AND**
- **POSITIVE ORGANIC PARAMETERS DETECTED.**

BACTERIOLOGICAL

Guidelines for bacteriological sampling and testing of a supply are developed to maintain a proper supervision of its bacteriological quality. Routine monitoring programs usually require that multiple samples be collected in a given system. Full interpretation of bacteriological quality cannot be made on the basis of single samples.

Standard plate count was the only bacteriological analysis conducted of the treated and distributed water. No results were reported above the guideline.

INORGANIC & PHYSICAL

CHEMISTRY (FIELD)

It is desirable that the temperature of drinking water be less than 15°C. The palatability of water is enhanced by its coolness. A temperature below 15°C will tend to reduce the growth of nuisance organisms and hence minimize associated taste, colour, odour and corrosion problems. The temperature of the delivered water may

increase in the distribution system due to the warming effect of the soil in late summer and fall and/or as a result of higher temperatures in the source water.

Field temperature exceeded the ODWO Maximum Desirable Concentration of 15°C in 3 of 11 treated and distributed water samples with a maximum reported value of 18.0°C.

CHEMISTRY (LAB)

The ODWOs indicate that a hardness level of between 80 and 100 mg/L as calcium carbonate for domestic waters provides an acceptable balance between corrosion and encrustation. Water supplies with a hardness greater than 200 mg/L are considered poor and would possess a tendency to form scale deposits and result in excessive soap consumption.

Hardness exceeded the ODWO Aesthetic or Recommended Operational Guideline of 80-100 mg/L in all 12 treated and distributed water samples with a maximum reported value of 146.8 mg/L.

METALS

At present, there is no evidence that aluminum is physiologically harmful and no health limit for drinking water has been specified. The measure of aluminum in treated water is important to indicate the efficiency of the treatment process. The ODWOs indicate that a useful guideline is to maintain a residual below 100 ug/L as aluminum in the water leaving the plant, to avoid problems in the distribution system.

Aluminum exceeded the ODWO Aesthetic or Recommended Operational Guideline of 100 ug/L in 3 of 12 treated and distributed water samples with a maximum reported value of 130.0 ug/L.

ORGANIC

CHLOROAROMATICS

The results of the chloroaromatic scan showed that none were detected.

CHLOROPHENOLS

The results of the chlorophenol scan showed that none were detected.

POLYAROMATIC HYDROCARBONS (PAH)

The results of the PAH scan showed that none were detected.

PESTICIDES & PCB

The results of the PCB scan showed that none were detected.

The results of the regular pesticide scan showed that none were detected in the treated and distributed water above trace levels.

One positive result for desethyl atrazine was reported in the raw water sample for June. This result was thought to be anomalous by the laboratory analytical staff.

PHENOLICS

Phenolic compounds are present in the aquatic environment as a result of natural and/or industrial processes. The ODWOs recommend, as an operational guideline, that phenolic substances in drinking water not exceed 2.0 ug/L. This limit has been set primarily to prevent undesirable taste and odours, particularly in chlorinated water. No results were reported above trace levels.

SPECIFIC PESTICIDES

The results of the specific pesticides scan showed that none were detected.

VOLATILES

The detection of benzene, ethylbenzene, toluene and xylenes at low, trace levels may be a laboratory artifact derived from the analytical methodology.

Trihalomethanes (THMs) are produced during the water treatment process and will always occur in chlorinated waters. THMs are comprised of chloroform, chlorodibromomethane and dichlorobromomethane; bromoform occurs occasionally. Results are reported for the individual compounds as well as for total THMs. Only total THMs results are discussed.

Total THMs were found at positive levels in the 12 treated and distributed water samples analyzed with a maximum level of 40.1 ug/L. This was below the ODWO Maximum Acceptable Concentration of 350 ug/L.

CONCLUSIONS

The Kingston water treatment plant, for the sample year 1990, produced good quality water which was maintained in the distribution system.

No known health related guidelines were exceeded.

FIGURE 1

KINGSTON WTP

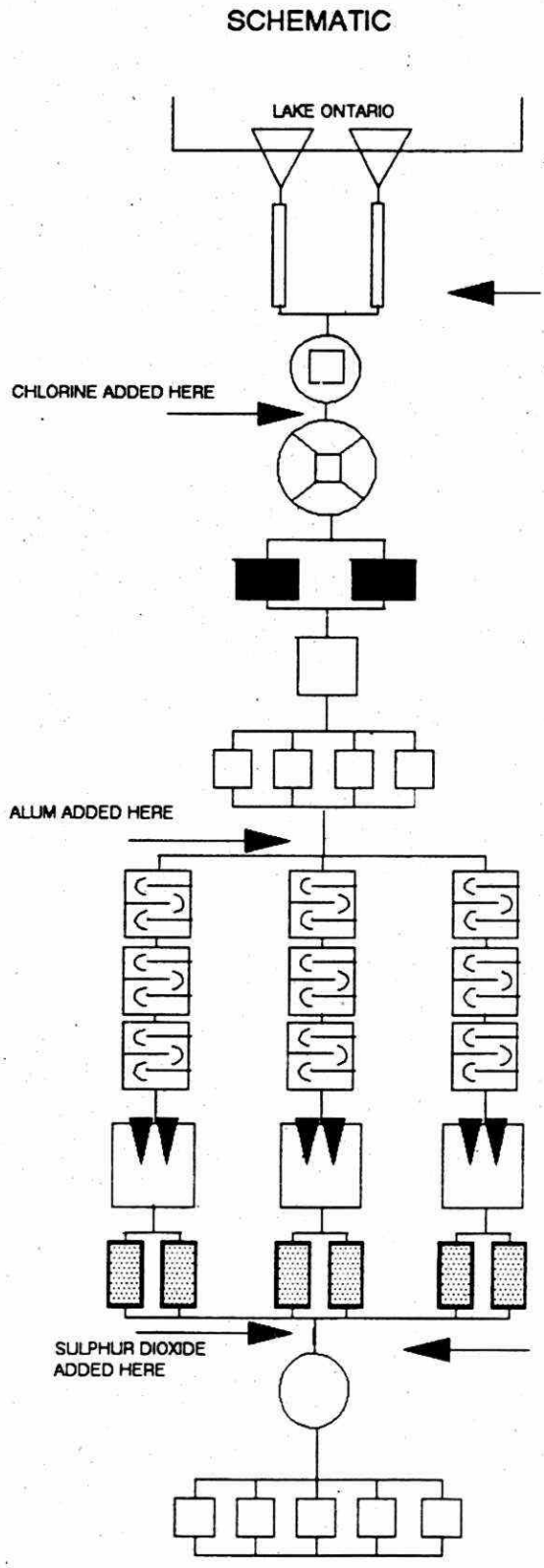

TABLE 1

DRINKING WATER SURVEILLANCE PROGRAM

PLANT GENERAL REPORT

WORKS #: 220001860
PLANT NAME: KINGSTON WTP

DISTRICT: KINGSTON
REGION: SOUTHEAST
DISTRICT OFFICER: J. TOOLEY

UTM #: 183799904896810

PLANT SUPERINTENDENT: KEN ALLEN

ADDRESS: 302 KING ST. WEST
KINGSTON, ONTARIO
K7L 2X1
(613 542 1763)

MUNICIPALITY: KINGSTON
AUTHORITY: MUNICIPAL

PLANT INFORMATION

PLANT VOLUME:	15.219	(X 1000 M3)
DESIGN CAPACITY:	94.400	(X 1000 M3/DAY)
RATED CAPACITY:	118.000	(X 1000 M3/DAY)

MUNICIPALITY	POPULATION
KINGSTON	80,500

TABLE 2
DRINKING WATER SURVEILLANCE PROGRAM
IN-PLANT MONITORING

PARAMETER	LOCATION	FREQUENCY
ALUMINUM	TREATED WATER	DAILY READING
COMBINED CHLORINE RESIDUAL	TREATED WATER	CONTINUOUS
FREE CHLORINE RESIDUAL	AFTER FILTERS	CONTINUOUS
TOTAL CHLORINE RESIDUAL	TREATED WATER	CONTINUOUS
PH	RAW WATER	DAILY READING
	TREATED WATER	DAILY READING
TEMPERATURE	RAW WATER	CONTINUOUS
TURBIDITY	RAW WATER	CONTINUOUS
	TREATED WATER	CONTINUOUS

TABLE 3

DRINKING WATER SURVEILLANCE PROGRAM KINGSTON WTP SAMPLE DAY CONDITIONS FOR 1990

			TREATMENT CHEMICAL DOSAGE (MG/L)		
			PRE CHLORINATION	COAGULATION	DECHLORINATION
			CHLORINE	ALUM LIQUID	SULPHUR DIOXIDE
DATE	DELAY * TIME(HRS)	FLOW (1000M3)			
FEB 06	23.00	55.000	1.60	7.60	.20
APR 03	6.70	54.000	1.40	9.70	.18
JUN 05	6.00	60.000	1.40	7.00	.06
AUG 14	7.40	50.000	1.60	6.30	.15
OCT 02	7.20	50.000	1.70	7.30	.27
DEC 04	7.00	52.000	1.40	8.70	.14

* THE DELAY TIME BETWEEN THE RAW AND TREATED WATER SAMPLING, SHOULD ESTIMATE THE RETENTION TIME.

TABLE 4
DRINKING WATER SURVEILLANCE PROGRAM KINGSTON WTP
SUMMARY TABLE OF RESULTS (1990)

SCAN PARAMETER	RAW			TREATED			SITE 2		
	TOTAL	POSITIVE	TRACE	TOTAL	POSITIVE	TRACE	TOTAL	POSITIVE	TRACE
BACTERIOLOGICAL									
FECAL COLIFORM MF	6	2	0	.	.	.	.	.	.
STANDRD PLATE CNT MF	.	.	.	6	0	0	6	1	0
TOTAL COLIFORM MF	6	4	0	.	.	.	.	.	.
T COLIFORM BCKGRD MF	6	6	0	.	.	.	.	.	.
*TOTAL GROUP BACTERIOLOGICAL	18	12	0	6	0	0	6	1	0
CHEMISTRY (FLD).									
FLD CHLORINE (COMB)	.	.	.	6	6	0	10	10	0
FLD CHLORINE FREE	.	.	.	6	6	0	10	0	0
FLD CHLORINE (TOTAL)	.	.	.	6	6	0	10	10	0
FLD PH	6	6	0	6	6	0	10	10	0
FLD TEMPERATURE	6	6	0	6	6	0	10	10	0
FLD TURBIDITY	6	6	0	6	6	0	.	.	.
*TOTAL SCAN CHEMISTRY (FLD)	18	18	0	36	36	0	50	40	0
CHEMISTRY (LAB)									
ALKALINITY	6	6	0	6	6	0	12	12	0
CALCIUM	6	6	0	6	6	0	12	12	0
CYANIDE	6	0	0	6	0	0	.	.	.
CHLORIDE	6	6	0	6	6	0	12	12	0
COLOUR	6	6	0	6	1	5	12	12	0
CONDUCTIVITY	6	6	0	6	6	0	12	12	0
DISS ORG CARBON	6	6	0	6	6	0	12	12	0
FLUORIDE	6	6	0	6	6	0	12	12	0
HARDNESS	6	6	0	6	6	0	12	12	0
IONCAL	6	6	0	6	6	0	12	12	0
LANGELIERS INDEX	6	6	0	6	6	0	12	12	0
MAGNESIUM	6	6	0	6	6	0	12	12	0
SODIUM	6	6	0	6	6	0	12	12	0
AMMONIUM TOTAL	6	1	1	6	0	2	12	0	3
NITRITE	6	1	4	6	1	4	12	1	11
TOTAL NITRATES	6	6	0	6	6	0	12	12	0
NITROGEN TOT KJELD	6	6	0	6	6	0	12	12	0
PH	6	6	0	6	6	0	12	12	0
PHOSPHORUS FIL REACT	6	0	2	6	0	3	.	.	.
PHOSPHORUS TOTAL	6	4	2	6	0	4	.	.	.
SULPHATE	6	6	0	6	6	0	12	12	0
TURBIDITY	6	6	0	6	4	2	12	12	0
*TOTAL SCAN CHEMISTRY (LAB)	132	108	9	132	96	20	228	205	14

TABLE 4
DRINKING WATER SURVEILLANCE PROGRAM KINGSTON WTP
SUMMARY TABLE OF RESULTS (1990)

SCAN PARAMETER	RAW			TREATED			SITE 2		
	TOTAL	POSITIVE	TRACE	TOTAL	POSITIVE	TRACE	TOTAL	POSITIVE	TRACE
METALS									
SILVER	6	0	0	6	0	0	12	0	0
ALUMINUM	6	6	0	6	6	0	12	12	0
ARSENIC	6	1	5	6	0	5	12	0	9
BARIUM	6	6	0	6	6	0	12	12	0
BORON	6	6	0	6	6	0	12	12	0
BERYLLIUM	6	0	0	6	0	0	12	0	1
CADMIUM	6	0	1	6	0	0	12	0	0
COBALT	6	0	3	6	0	4	12	0	6
CHROMIUM	6	0	5	6	0	6	12	0	12
COPPER	6	6	0	6	0	6	12	6	6
IRON	6	0	6	6	0	0	12	12	0
MERCURY	6	0	2	6	0	1	.	.	.
MANGANESE	6	6	0	6	3	3	12	12	0
MOLYBDENUM	6	6	0	6	6	0	12	12	0
NICKEL	6	0	3	6	0	3	12	0	8
LEAD	6	0	6	6	0	1	12	2	10
ANTIMONY	6	5	1	6	3	3	12	9	3
SELENIUM	6	0	0	6	0	2	12	0	4
STRONTIUM	6	6	0	6	6	0	12	12	0
TITANIUM	6	2	4	6	2	4	12	3	9
THALLIUM	6	0	0	6	0	0	12	0	0
URANIUM	6	0	6	6	0	6	12	0	12
VANADIUM	6	0	6	6	1	4	12	2	10
ZINC	6	6	0	6	1	5	12	12	0
*TOTAL SCAN METALS	144	56	48	144	40	53	276	118	90
*TOTAL GROUP INORGANIC & PHYSICAL	294	182	57	312	172	73	554	363	104
CHLOROAROMATICS									
HEXACHLOROBUTADIENE	5	0	0	5	0	0	5	0	0
123 TRICHLOROBENZENE	5	0	0	5	0	0	5	0	0
1234 T-CHLOROBENZENE	5	0	0	5	0	0	5	0	0
1235 T-CHLOROBENZENE	5	0	0	5	0	0	5	0	0
124 TRICHLOROBENZENE	5	0	0	5	0	0	5	0	0
1245 T-CHLOROBENZENE	5	0	0	5	0	0	5	0	0
135 TRICHLOROBENZENE	5	0	0	5	0	0	5	0	0
HCB	5	0	0	5	0	0	5	0	0
HEXACHLOROETHANE	5	0	0	5	0	0	5	0	0
OCTACHLOROSTYRENE	5	0	0	5	0	0	5	0	0
PENTACHLOROBENZENE	5	0	0	5	0	0	5	0	0
236 TRICHLOROTOLUENE	5	0	0	5	0	0	5	0	0
245 TRICHLOROTOLUENE	5	0	0	5	0	0	5	0	0
26A TRICHLOROTOLUENE	5	0	0	5	0	0	5	0	0
*TOTAL SCAN CHLOROAROMATICS	70	0	0	70	0	0	70	0	0

TABLE 4
DRINKING WATER SURVEILLANCE PROGRAM KINGSTON WTP
SUMMARY TABLE OF RESULTS (1990)

SCAN PARAMETER	RAW			TREATED			SITE 2		
	TOTAL	POSITIVE	TRACE	TOTAL	POSITIVE	TRACE	TOTAL	POSITIVE	TRACE
CHLOROPHENOLS									
234 TRICHLOROPHENOL	2	0	0	2	0	0	.	.	.
2345 T-CHLOROPHENOL	2	0	0	2	0	0	.	.	.
2356 T-CHLOROPHENOL	2	0	0	2	0	0	.	.	.
245-TRICHLOROPHENOL	2	0	0	2	0	0	.	.	.
246-TRICHLOROPHENOL	2	0	0	2	0	0	.	.	.
PENTACHLOROPHENOL	2	0	0	2	0	0	.	.	.
*TOTAL SCAN CHLOROPHENOLS	12	0	0	12	0	0	0	0	0
PAH									
PHENANTHRENE	5	0	0	5	0	0	1	0	0
ANTHRACENE	5	0	0	5	0	0	1	0	0
FLUORANTHENE	5	0	0	5	0	0	1	0	0
PYRENE	5	0	0	5	0	0	1	0	0
BENZO(A)ANTHRACENE	5	0	0	5	0	0	1	0	0
CHRYSENE	5	0	0	5	0	0	1	0	0
DIMETH. BENZ(A)ANTHR	5	0	0	5	0	0	1	0	0
BENZO(E) PYRENE	5	0	0	5	0	0	1	0	0
BENZO(B) FLUORANTHEN	5	0	0	5	0	0	1	0	0
PERYLENE	5	0	0	5	0	0	1	0	0
BENZO(K) FLUORANTHEN	5	0	0	5	0	0	1	0	0
BENZO(A) PYRENE	5	0	0	5	0	0	1	0	0
BENZO(G,H,I) PERYLEN	5	0	0	5	0	0	1	0	0
DIBENZO(A,H) ANTHRAC	5	0	0	5	0	0	1	0	0
INDENO(1,2,3-C,D) PY	5	0	0	5	0	0	1	0	0
BENZO(B) CHRYSENE	5	0	0	5	0	0	1	0	0
CORONENE	5	0	0	5	0	0	1	0	0
*TOTAL SCAN PAH	85	0	0	85	0	0	17	0	0
PESTICIDES & PCB									
ALDRIN	5	0	0	5	0	0	5	0	0
ALPHA BHC	5	0	2	5	0	2	5	0	3
BETA BHC	5	0	0	5	0	0	5	0	0
LINDANE	5	0	0	5	0	1	5	0	0
ALPHA CHLORDANE	5	0	0	5	0	0	5	0	0
GAMMA CHLORDANE	5	0	0	5	0	0	5	0	0
DIELDRIN	5	0	0	5	0	0	5	0	0
METHOXYCHLOR	5	0	0	5	0	0	5	0	0
ENDOSULFAN 1	5	0	0	5	0	0	5	0	0
ENDOSULFAN II	5	0	0	5	0	0	5	0	0
ENDRIN	5	0	0	5	0	0	5	0	0
ENDOSULFAN SULPHATE	5	0	0	5	0	0	5	0	0
HEPTACHLOR EPOXIDE	5	0	0	5	0	0	5	0	0
HEPTACHLOR	5	0	0	5	0	0	5	0	0
MIREX	5	0	0	5	0	0	5	0	0
OXYCHLORDANE	5	0	0	5	0	0	5	0	0
OPDDT	5	0	0	5	0	0	5	0	0
PCB	5	0	0	5	0	0	5	0	0
DDD	5	0	0	5	0	0	5	0	0
PPDDE	5	0	0	5	0	0	5	0	0

TABLE 4
DRINKING WATER SURVEILLANCE PROGRAM KINGSTON WTP
SUMMARY TABLE OF RESULTS (1990)

SCAN PARAMETER	RAW TOTAL	RAW POSITIVE	RAW TRACE	TREATED TOTAL	TREATED POSITIVE	TREATED TRACE	SITE 2 TOTAL	SITE 2 POSITIVE	SITE 2 TRACE
PPDDT	5	0	0	5	0	0	5	0	0
AMETRINE	6	0	0	6	0	0	.	.	.
ATRAZINE	6	0	1	6	0	0	.	.	.
ATRATONE	6	0	0	6	0	0	.	.	.
CYANAZINE (BLADEX)	6	0	0	6	0	0	.	.	.
DESETHYLATRAZINE	6	1	0	6	0	0	.	.	.
D-ETHYL SIMAZINE	6	0	0	6	0	0	.	.	.
PROMETONE	6	0	0	6	0	0	.	.	.
PROPAZINE	6	0	0	6	0	0	.	.	.
PROMETRYNE	6	0	0	6	0	0	.	.	.
METRIBUZIN (SENCOR)	6	0	0	6	0	0	.	.	.
SIMAZINE	6	0	0	6	0	0	.	.	.
ALACHLOR (LASSO)	6	0	0	6	0	0	.	.	.
METOLACHLOR	6	0	0	6	0	0	.	.	.
HEXACLCYCLOPENTADIEN	1	0	0	1	0	0	1	0	0
*TOTAL SCAN PESTICIDES & PCB	184	1	3	184	0	3	106	0	3
PHENOLICS									
PHENOLICS	6	1	4	6	0	5	.	.	.
*TOTAL SCAN PHENOLICS	6	1	4	6	0	5	0	0	0
SPECIFIC PESTICIDES									
TOXAPHENE	5	0	0	5	0	0	5	0	0
2,4,5-T	2	0	0	2	0	0	.	.	.
2,4-D	1	0	0	1	0	0	.	.	.
2,4-DB	2	0	0	2	0	0	.	.	.
2,4 D PROPIONIC ACID	2	0	0	2	0	0	.	.	.
DICAMBA	1	0	0	1	0	0	.	.	.
PICHLORAM	0	0	0	0	0	0	.	.	.
SILVEX	2	0	0	2	0	0	.	.	.
DIAZINON	2	0	0	2	0	0	.	.	.
DICHLOROVOS	2	0	0	2	0	0	.	.	.
CHLORPYRIFOS	2	0	0	2	0	0	.	.	.
ETHION	2	0	0	2	0	0	.	.	.
AZINPHOS-METHYL	0	0	0	0	0	0	.	.	.
MALATHION	2	0	0	2	0	0	.	.	.
MEVINPHOS	2	0	0	2	0	0	.	.	.
METHYL PARATHION	2	0	0	2	0	0	.	.	.
METHYLTRITHION	2	0	0	2	0	0	.	.	.
PARATHION	2	0	0	2	0	0	.	.	.
PHORATE	1	0	0	1	0	0	.	.	.
RELDAN	2	0	0	2	0	0	.	.	.
RONNEL	2	0	0	2	0	0	.	.	.
AMINOCARB	0	0	0	0	0	0	.	.	.
BENONYL	0	0	0	0	0	0	.	.	.
BUX	0	0	0	0	0	0	.	.	.
CARBOFURAN	2	0	0	2	0	0	.	.	.
CICP	2	0	0	2	0	0	.	.	.
DIALLATE	2	0	0	2	0	0	.	.	.

TABLE 4
DRINKING WATER SURVEILLANCE PROGRAM KINGSTON WTP
SUMMARY TABLE OF RESULTS (1990)

SCAN PARAMETER	RAW			TREATED			SITE 2		
	TOTAL	POSITIVE	TRACE	TOTAL	POSITIVE	TRACE	TOTAL	POSITIVE	TRACE
EPTAM	2	0	0	2	0	0	.	.	.
IPC	2	0	0	2	0	0	.	.	.
PROPOXUR	2	0	0	2	0	0	.	.	.
CARBARYL	2	0	0	2	0	0	.	.	.
BUTYLATE	2	0	0	2	0	0	.	.	.
*TOTAL SCAN SPECIFIC PESTICIDES	54	0	0	54	0	0	5	0	0
VOLATILES									
BENZENE	5	0	0	6	0	1	6	0	0
TOLUENE	5	0	0	6	0	1	6	0	0
ETHYLBENZENE	5	0	3	6	0	3	6	0	4
P-XYLENE	5	0	0	6	0	0	6	0	0
M-XYLENE	5	0	0	6	0	0	6	0	0
O-XYLENE	5	0	0	6	0	0	6	0	0
STYRENE	5	0	3	6	0	4	6	0	3
1,1 DICHLOROETHYLENE	5	0	0	6	0	0	6	0	0
METHYLENE CHLORIDE	5	0	0	6	0	0	6	0	0
T1,2DICHLOROETHYLENE	5	0	0	6	0	0	6	0	0
1,1 DICHLOROETHANE	5	0	0	6	0	0	6	0	0
CHLOROFORM	5	0	0	6	6	0	6	6	0
111, TRICHLOROETHANE	5	0	0	6	0	0	6	0	0
1,2 DICHLOROETHANE	5	0	0	6	0	0	6	0	0
CARBON TETRACHLORIDE	5	0	0	6	0	0	6	0	0
1,2 DICHLOROPROPANE	5	0	0	6	0	0	6	0	0
TRICHLOROETHYLENE	5	0	0	6	0	0	6	0	0
DICHLOROBROMOMETHANE	5	0	0	6	6	0	6	6	0
112 TRICHLOROETHANE	5	0	0	6	0	0	6	0	0
CHLORODIBROMOMETHANE	5	0	0	6	6	0	6	6	0
T-CHLOROETHYLENE	5	0	0	6	0	0	6	0	0
BROMOFORM	5	0	0	6	0	3	6	0	5
1122 T-CHLOROETHANE	5	0	0	6	0	0	6	0	0
CHLOROBENZENE	5	0	0	6	0	0	6	0	0
1,4 DICHLOROBENZENE	5	0	0	6	0	0	6	0	0
1,3 DICHLOROBENZENE	5	0	0	6	0	0	6	0	0
1,2 DICHLOROBENZENE	5	0	0	6	0	0	6	0	0
ETHLYENE DIBROMIDE	5	0	0	6	0	0	6	0	0
TOTL TRIHALOMETHANES	5	0	0	6	6	0	6	6	0
*TOTAL SCAN VOLATILES	145	0	6	174	24	12	174	24	12
*TOTAL GROUP ORGANIC	556	2	13	585	24	20	372	24	15

KEY TO TABLE 5 and 6

A ONTARIO DRINKING WATER OBJECTIVES (ODWO)
1. Maximum Acceptable Concentration (MAC)
1+. MAC for Total Trihalomethanes
2. Interim Maximum Acceptable Concentration (IMAC)
3. Aesthetic Objective (AO)
3*. AO for Total Xylenes
4. Recommended Operational Guideline

B HEALTH & WELFARE CANADA (H&W)
1. Maximum Acceptable Concentration (MAC)
2. Proposed MAC
3. Interim MAC
4. Aesthetic Objective (AO)

C WORLD HEALTH ORGANIZATION (WHO)
1. Guideline Value (GV)
2. Tentative GV
3. Aesthetic GV

D US ENVIRONMENTAL PROTECTION AGENCY (EPA)
1. Maximum Contaminant Level (MCL)
2. Suggested No-Adverse Effect Level (SNAEL)
3. Lifetime Health Advisory
4. EPA Ambient Water Quality Criteria
4T. EPA Ambient Water Quality Criteria for Total PAH

F EUROPEAN ECONOMIC COMMUNITY (EEC)
1. Health Related Guideline Level
2. Aesthetic Guideline Level
3. Maximum Admissable Concentration (MADC)

G CALIFORNIA STATE DEPARTMENT OF HEALTH-GUIDELINE VALUE

I NEW YORK STATE AMBIENT WATER GUIDELINE

N/A NONE AVAILABLE

LABORATORY RESULTS, REMARK DESCRIPTIONS

.	No Sample Taken
BDL	Below Minimum Measurement Amount
<T	Greater Than Detection Limit But Not Confident (SEE INTERPRETATION OF RESULTS ABOVE)
>	Results Are Greater Than The Upper Limit
<=>	Approximate Result
!CS	No Data: Contamination Suspected
!IL	No Data: Sample Incorrectly Labelled
!IS	No Data: Insufficient Sample
!IV	No Data: Inverted Septum
!LA	No Data: Laboratory Accident
!LD	No Data: Test Queued After Sample Discarded
!NA	No Data: No Authorization To Perform Reanalysis
!NP	No Data: No Procedure
!NR	No Data: Sample Not Received
!OP	No Data: Obscured Plate
!QU	No Data: Quality Control Unacceptable
!PE	No Data: Procedural Error - Sample Discarded
!PH	No Data: Sample pH Outside Valid Range
!RE	No Data: Received Empty
!RO	No Data: See Attached Report (no numeric results)
!SM	No Data: Sample Missing
!SS	No Data: Send Separate Sample Properly Preserved
!UI	No Data: Indeterminant Interference
!TX	No Data: Time Expired
A3C	Approximate, Total Count Exceeded 300 Colonies
APL	Additional Peak, Large, Not Priority Pollutant
APS	Additional Peak, Less Than, Not Priority Pollutant
CIC	Possible Contamination, Improper Cap
CRO	Calculated Result Only
PPS	Test Performed On Preserved Sample
RMP	P and M-Xylene Not Separated
RRV	Rerun Verification
RVU	Reported Value Unusual
SPS	Several Peaks, Small, Not Priority Pollutant

UCR		Unreliable: Could Not Confirm By Reanalysis
UCS		Unreliable: Contamination Suspected
UIN		Unreliable: Indeterminate Interference
XP		Positive After X Number Of Hours
T#	(T06)	Result Taken After # Hours

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM KINGSTON WTP 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 2	
			STANDING	FREE FLOW
BACTERIOLOGICAL				
FECAL COLIFORM MF (CT/100ML)			DET'N LIMIT = 0	GUIDELINE = 0 (A1)
FEB	0	.	.	.
APR	0	.	.	.
JUN	1	.	.	.
AUG	BDL	.	.	.
OCT	2	.	.	.
DEC	0	.	.	.
STANDRD PLATE CNT MF (COUNT/ML)			DET'N LIMIT = 0	GUIDELINE = 500/ML (A3)
FEB	.	1 <=>	.	9 <=>
APR	.	8 <=>	.	1 <=>
JUN	.	0 <=>	.	0 <=>
AUG	.	0 <=>	.	9 <=>
OCT	.	2 <=>	.	29
DEC	.	0 <=>	.	0 <=>
TOTAL COLIFORM MF (CT/100ML)			DET'N LIMIT = 0	GUIDELINE = 5/100ML(A1)
FEB	28	.	.	.
APR	BDL	.	.	.
JUN	4	.	.	.
AUG	16	.	.	.
OCT	2	.	.	.
DEC	0	.	.	.
T COLIFORM BCKGRD MF (CT/100ML)			DET'N LIMIT = 0	GUIDELINE = N/A
FEB	72	.	.	.
APR	20	.	.	.
JUN	48	.	.	.
AUG	100	.	.	.
OCT	47	.	.	.
DEC	114	.	.	.

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM KINGSTON WTP 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 2	
			STANDING	FREE FLOW
CHEMISTRY (FLD)				
FLD CHLORINE (COMB) (MG/L)			DET'N LIMIT = 0	GUIDELINE = N/A
FEB	.	.210	.100	.100
APR	.	.140	.100	.100
JUN	.	.150	.100	.100
AUG	.	.140	.100	.100
OCT	.	.160	.100	.100
DEC	.	.170	.	.
FLD CHLORINE FREE (MG/L)			DET'N LIMIT = 0	GUIDELINE = N/A
FEB	.	.320	.000	.000
APR	.	.400	.000	.000
JUN	.	.320	.000	.000
AUG	.	.360	.000	.000
OCT	.	.360	.000	.000
DEC	.	.350	.	.
FLD CHLORINE (TOTAL) (MG/L)			DET'N LIMIT = 0	GUIDELINE = N/A
FEB	.	.530	.100	.100
APR	.	.540	.100	.100
JUN	.	.470	.100	.100
AUG	.	.500	.100	.100
OCT	.	.520	.100	.100
DEC	.	.520	.	.
FLD PH (DMNSLESS)			DET'N LIMIT = N/A	GUIDELINE = 6.5-8.5(A4)
FEB	7.800	7.400	7.600	7.600
APR	7.900	7.400	7.600	7.600
JUN	8.200	7.700	7.600	7.600
AUG	7.600	7.400	7.600	7.400
OCT	7.900	7.600	7.600	7.600
DEC	7.600	7.400	.	.
FLD TEMPERATURE (DEG.C)			DET'N LIMIT = N/A	GUIDELINE = 15 (A3)
FEB	.600	3.000	10.000	5.000
APR	1.700	4.500	10.000	6.000
JUN	11.000	12.000	13.000	12.000
AUG	13.700	13.900	19.000	18.000
OCT	15.000	16.000	17.500	17.000
DEC	6.300	7.500	.	.
FLD TURBIDITY (FTU)			DET'N LIMIT = N/A	GUIDELINE = 1 (A1)
FEB	.850	.180	.	.
APR	.750	.050	.	.
JUN	.650	.100	.	.
AUG	1.000	.080	.	.
OCT	.800	.060	.	.
DEC	.750	.080	.	.

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM KINGSTON WTP 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 2	
			STANDING	FREE FLOW
CHEMISTRY (LAB)				
ALKALINITY (MG/L)			DET'N LIMIT = 0.2	GUIDELINE = 30-500 (A3)
FEB	106.600	99.000	100.200	97.900
APR	104.100	95.900	97.500	97.100
JUN	101.100	96.700	95.400	95.200
AUG	105.400	99.800	98.700	98.500
OCT	95.400	92.900	97.000	96.200
DEC	100.000	94.200	94.900	94.300
CALCIUM (MG/L)			DET'N LIMIT = 0.2	GUIDELINE = 100 (F2)
FEB	43.400	43.200	42.800	42.400
APR	41.000	40.600	41.200	40.600
JUN	39.900	39.400	40.600	38.800
AUG	44.900	44.900	42.700	43.300
OCT	38.600	38.200	42.000	42.800
DEC	41.300	40.200	40.900	40.200
CHLORIDE (MG/L)			DET'N LIMIT = 0.2	GUIDELINE = 250 (A3)
FEB	20.000	21.000	21.700	22.400
APR	21.400	22.600	22.300	22.400
JUN	19.900	21.500	22.800	23.100
AUG	21.000	21.900	22.300	22.100
OCT	21.500	23.000	22.900	22.800
DEC	21.700	23.000	23.900	23.800
COLOUR (HZU)			DET'N LIMIT = 0.5	GUIDELINE = 5 (A3)
FEB	7.500	3.000	4.500	.500
APR	3.500	.500 <T	4.500	4.500
JUN	4.500	1.500 <T	4.500	4.500
AUG	3.000	1.000 <T	2.500	2.500
OCT	2.500	.500 <T	3.000	3.000
DEC	2.500	1.000 <T	3.000	3.500
CONDUCTIVITY (UMHO/CM)			DET'N LIMIT = 1.	GUIDELINE = 400 (F2)
FEB	321	322	324	322
APR	324	326	330	329
JUN	308	317	320	321
AUG	326	329	327	328
OCT	310	323	327	327
DEC	318	322	325	323
DISS ORG CARBON (MG/L)			DET'N LIMIT = .100	GUIDELINE = 5.0 (A3)
FEB	3.100	2.700	2.300	2.500
APR	2.300	2.000	1.900	1.800
JUN	2.300	1.800	2.000	1.800
AUG	2.100	1.800	1.500	1.500
OCT	2.200	1.800	1.600	1.500
DEC	1.900	1.800	1.500	1.500

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM KINGSTON WTP 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 2	
			STANDING	FREE FLOW
FLUORIDE (MG/L)			DET'N LIMIT = 0.01	GUIDELINE = 2.4 (A1)
FEB	.120	.100	.100	.080
APR	.120	.100	.160	.120
JUN	.120	.120	.120	.120
AUG	.140	.120	.120	.120
OCT	.120	.120	.120	.120
DEC	.120	.120	.120	.120
HARDNESS (MG/L)			DET'N LIMIT = 0.5	GUIDELINE = 80-100 (A4)
FEB	141.000	140.000	140.000	140.000
APR	136.000	135.000	136.000	135.000
JUN	130.300	129.700	133.900	129.600
AUG	146.900	146.800	140.600	141.300
OCT	131.000	131.000	139.000	141.000
DEC	138.600	135.800	137.000	135.300
IONCAL (DMNSLESS)			DET'N LIMIT = N/A	GUIDELINE = N/A
FEB	1.779	1.275	.943	1.924
APR	.487	.764	1.067	1.606
JUN	1.192	2.501	.194	3.316
AUG	5.219	6.198	2.801	3.782
OCT	.793	2.132	2.964	4.487
DEC	2.550	1.023	1.019	.187
LANGELIERS INDEX (DMNSLESS)			DET'N LIMIT = N/A	GUIDELINE = N/A
FEB	.442	.388	.259	.135
APR	.507	.386	.420	.392
JUN	.454	.278	.175	.144
AUG	.391	.237	.221	.216
OCT	.384	.367	.416	.381
DEC	.453	.345	.335	.275
MAGNESIUM (MG/L)			DET'N LIMIT = 0.1	GUIDELINE = 30 (F2)
FEB	7.900	7.900	8.000	8.300
APR	8.100	8.100	8.100	8.200
JUN	7.450	7.600	7,950	7.950
AUG	8.450	8.450	8.300	8.050
OCT	8.400	8.600	8.400	8.300
DEC	8.650	8.600	8.450	8.500
SODIUM (MG/L)			DET'N LIMIT = 0.2	GUIDELINE = 200 (A4)
FEB	10.800	10.200	11.000	11.000
APR	11.400	11.000	11.200	11.200
JUN	10.400	10.800	11.200	11.300
AUG	11.200	11.600	11.900	12.100
OCT	11.200	11.000	12.000	12.000
DEC	11.300	11.200	11.500	11.500

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM KINGSTON WTP 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 2	
			STANDING	FREE FLOW
AMMONIUM TOTAL (MG/L)			**DET'N LIMIT = 0.002**	**GUIDELINE = 0.05 (F2)**
FEB	.018	BDL	BDL	BDL
APR	BDL	BDL	BDL	BDL
JUN	BDL	BDL	BDL	BDL
AUG	BDL	.004 <T	.006 <T	.002 <T
OCT	BDL	BDL	BDL	BDL
DEC	.002 <T	.004 <T	.002 <T	BDL
NITRITE (MG/L)			**DET'N LIMIT = 0.001**	**GUIDELINE = 1 (A1)**
FEB	.003 <T	.001 <T	.001 <T	.004 <T
APR	.002 <T	.001 <T	.002 <T	.002 <T
JUN	.002 <T	.001 <T	.001 <T	.001 <T
AUG	.004 <T	.002 <T	.003 <T	.002 <T
OCT	BDL	BDL	.001 <T	.001 <T
DEC	.007	.005	.004 <T	.006
TOTAL NITRATES (MG/L)			**DET'N LIMIT = 0.005**	**GUIDELINE = 10 (A1)**
FEB	.330	.325	.335	.325
APR	.310	.310	.320	.315
JUN	.270	.270	.295	.305
AUG	.340	.335	.325	.315
OCT	.205	.205	.245	.230
DEC	.260	.250	.275	.270
NITROGEN TOT KJELD (MG/L)			**DET'N LIMIT = 0.02**	**GUIDELINE = N/A**
FEB	.350	.260	.250	.300
APR	.360	.210	.210	.180
JUN	.290	.180	.170	.150
AUG	.250	.190	.200	.180
OCT	.280	.170	.170	.180
DEC	.180	.130	.120	.110
PH (DMNSLESS)			**DET'N LIMIT = N/A**	**GUIDELINE = 6.5-8.5(A4)**
FEB	8.220	8.200	8.070	7.960
APR	8.320	8.240	8.260	8.240
JUN	8.290	8.140	8.030	8.020
AUG	8.160	8.030	8.040	8.030
OCT	8.260	8.260	8.250	8.210
DEC	8.280	8.210	8.190	8.140
PHOSPHORUS FIL REACT (MG/L)			**DET'N LIMIT = 0.0005**	**GUIDELINE = N/A**
FEB	.002 <T	.000 <T	.	.
APR	BDL	BDL	.	.
JUN	BDL	.002 <T	.	.
AUG	BDL	BDL	.	.
OCT	.001 <T	.001 <T	.	.
DEC	BDL	BDL	.	.

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM KINGSTON WTP 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 2	
			STANDING	FREE FLOW
PHOSPHORUS TOTAL (MG/L)			DET'N LIMIT = 0.002	GUIDELINE = .40 (F2)
FEB	.014	.003 <T	.	.
APR	.014	.005 <T	.	.
JUN	.012	.008 <T	.	.
AUG	.007 <T	.002 <T	.	.
OCT	.012	BDL	.	.
DEC	.009 <T	BDL	.	.
SULPHATE (MG/L)			DET'N LIMIT = .200	GUIDELINE = 500 (A3)
FEB	24.490	29.450	28.940	28.970
APR	24.780	29.660	30.830	30.870
JUN	23.540	27.780	28.910	29.170
AUG	25.410	28.960	29.560	29.410
OCT	26.460	30.580	29.310	29.480
DEC	26.530	29.690	29.410	29.940
TURBIDITY (FTU)			DET'N LIMIT = 0.05	GUIDELINE = 1 (A1)
FEB	1.500	.390	.740	5.600
APR	1.430	.370	.730	.790
JUN	1.080	.330	.700	.680
AUG	1.200	.220 <T	.780	.520
OCT	.910	.240 <T	.620	.590
DEC	1.130	.440	.840	.950

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM KINGSTON WTP 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 2	
			STANDING	FREE FLOW
METALS				
ALUMINUM (UG/L)			DET'N LIMIT = 0.1	GUIDELINE = 100 (A4)
FEB	17.000	120.000	83.000	71.000
APR	13.000	67.000	54.000	52.000
JUN	10.000	130.000	79.000	76.000
AUG	4.900	59.000	74.000	63.000
OCT	6.900	110.000	90.000	90.000
DEC	9.300	70.000	54.000	52.000
ARSENIC (UG/L)			DET'N LIMIT = 0.10	GUIDELINE = 25 (A1)
FEB	1.000 <T	.420 <T	.350 <T	.320 <T
APR	.940 <T	.630 <T	.730 <T	.580 <T
JUN	.230 <T	BDL	BDL	BDL
AUG	1.000 <T	.340 <T	.180 <T	.330 <T
OCT	1.100	.610 <T	.710 <T	.640 <T
DEC	.760 <T	.140 <T	.220 <T	BDL
BARIUM (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 1000 (A2)
FEB	31.000	29.000	26.000	26.000
APR	24.000	22.000	22.000	22.000
JUN	25.000	24.000	24.000	24.000
AUG	24.000	24.000	23.000	23.000
OCT	23.000	23.000	24.000	24.000
DEC	22.000	21.000	21.000	20.000
BORON (UG/L)			DET'N LIMIT = 2.00	GUIDELINE = 5000 (A1)
FEB	23.000	24.000	25.000	26.000
APR	36.000	32.000	39.000	36.000
JUN	74.000	62.000	54.000	42.000
AUG	33.000	33.000	31.000	31.000
OCT	43.000	38.000	30.000	41.000
DEC	26.000	24.000	24.000	24.000
BERYLLIUM (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 6800 (D4)
FEB	BDL	BDL	BDL	BDL
APR	BDL	BDL	BDL	BDL
JUN	BDL	BDL	BDL	BDL
AUG	BDL	BDL	BDL	BDL
OCT	BDL	BDL	.060 <T	BDL
DEC	BDL	BDL	BDL	BDL
CADMIUM (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 5 (A1)
FEB	BDL	BDL	BDL	BDL
APR	.060 <T	BDL	BDL	BDL
JUN	BDL	BDL	BDL	BDL
AUG	BDL	BDL	BDL	BDL
OCT	BDL	BDL	BDL	BDL
DEC	BDL	BDL	BDL	BDL

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM KINGSTON WTP 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 2	
			STANDING	FREE FLOW
COBALT (UG/L)			DET'N LIMIT = 0,02	GUIDELINE = N/A
FEB	.080 <T	.100 <T	.060 <T	.040 <T
APR	.130 <T	.120 <T	.100 <T	.090 <T
JUN	BDL	.280 <T	BDL	BDL
AUG	BDL	BDL	BDL	BDL
OCT	BDL	BDL	BDL	BDL
DEC	.130 <T	.070 <T	.100 <T	.110 <T
CHROMIUM (UG/L)			DET'N LIMIT = 0.50	GUIDELINE = 50 (A1)
FEB	BDL	.900 <T	.690 <T	.720 <T
APR	2.000 <T	1.200 <T	2.300 <T	2.000 <T
JUN	3.700 <T	2.900 <T	2.200 <T	1.600 <T
AUG	2.200 <T	2.300 <T	2.100 <T	1.800 <T
OCT	3.400 <T	2.500 <T	1.100 <T	3.100 <T
DEC	.930 <T	.720 <T	.820 <T	.600 <T
COPPER (UG/L)			DET'N LIMIT = 0.50	GUIDELINE = 1000 (A3)
FEB	82.000	.980 <T	14.000	3.500 <T
APR	44.000	1.200 <T	15.000	3.500 <T
JUN	55.000	1.200 <T	10.000	3.900 <T
AUG	94.000	1.200 <T	11.000	4.100 <T
OCT	78.000	1.800 <T	10.000	4.700 <T
DEC	40.000	.910 <T	9.800	3.100 <T
IRON (UG/L)			DET'N LIMIT = 6.00	GUIDELINE = 300 (A3)
FEB	28.000 <T	BDL	150.000	170.000
APR	7.400 <T	BDL	150.000	170.000
JUN	7.000 <T	BDL	140.000	140.000
AUG	9.600 <T	BDL	93.000	89.000
OCT	8.500 <T	BDL	110.000	110.000
DEC	10.000 <T	BDL	97.000	100.000
MERCURY (UG/L)			DET'N LIMIT = 0.02	GUIDELINE = 1 (A1)
FEB	BDL	BDL	.	.
APR	BDL	BDL	.	.
JUN	BDL	BDL	.	.
AUG	BDL	BDL	.	.
OCT	.090 <T	.040 <T	.	.
DEC	.070 <T	BDL	.	.
MANGANESE (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 50 (A3)
FEB	4.400	.780	4.500	5.000
APR	2.400	.220 <T	3.800	4.300
JUN	4.300	.650	4.500	4.600
AUG	20.000	.850	4.200	4.300
OCT	6.500	.340 <T	5.500	5.900
DEC	2.100	.180 <T	4.800	5.800

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM KINGSTON WTP 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 2	
			STANDING	FREE FLOW
MOLYBDENUM (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = N/A
FEB	.970	1.100	1.100	1.100
APR	1.100	1.100	1.200	1.100
JUN	.890	.890	1.000	1.000
AUG	1.000	1.100	1.100	1.100
OCT	1.200	1.100	1.300	1.200
DEC	1.100	1.200	1.100	1.100
NICKEL (UG/L)			DET'N LIMIT = 0.20	GUIDELINE = 350 (D3)
FEB	BDL	.290 <T	.310 <T	BDL
APR	.280 <T	.220 <T	.900 <T	.710 <T
JUN	BDL	BDL	.240 <T	BDL
AUG	BDL	BDL	BDL	BDL
OCT	1.400 <T	1.700 <T	1.400 <T	1.600 <T
DEC	.400 <T	BDL	.360 <T	.370 <T
LEAD (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 10. (A1)
FEB	.260 <T	.090 <T	.500 <T	.090 <T
APR	.110 <T	BDL	.600	.130 <T
JUN	.140 <T	BDL	.420 <T	.080 <T
AUG	.110 <T	BDL	.560	.180 <T
OCT	.110 <T	BDL	.420 <T	.250 <T
DEC	.080 <T	BDL	.330 <T	.140 <T
ANTIMONY (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 146 (D4)
FEB	.530	.480 <T	.550	.600
APR	.520	.520	.480 <T	.520
JUN	.540	1.700	.480 <T	.590
AUG	.570	.480 <T	.590	.620
OCT	.620	.600	.560	.620
DEC	.480 <T	.350 <T	.490 <T	.520
SELENIUM (UG/L)			DET'N LIMIT = 1.00	GUIDELINE = 10 (A1)
FEB	BDL	BDL	BDL	BDL
APR	BDL	BDL	BDL	BDL
JUN	BDL	BDL	BDL	1.900 <T
AUG	BDL	1.400 <T	1.100 <T	BDL
OCT	BDL	1.600 <T	2.100 <T	2.100 <T
DEC	BDL	BDL	BDL	BDL
STRONTIUM (UG/L)			DET'N LIMIT = 0.10	GUIDELINE = N/A
FEB	220.000	210.000	210.000	220.000
APR	190.000	200.000	200.000	200.000
JUN	180.000	180.000	170.000	170.000
AUG	180.000	180.000	180.000	180.000
OCT	200.000	200.000	200.000	200.000
DEC	170.000	170.000	180.000	180.000

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM KINGSTON WTP 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 2	
			STANDING	FREE FLOW
TITANIUM (UG/L)			DET'N LIMIT = 0.50	GUIDELINE = N/A
FEB	7.800	7.800	6.600	6.800
APR	3.800 <T	3.700 <T	3.800 <T	3.700 <T
JUN	4.900 <T	4.200 <T	5.200	4.500 <T
AUG	5.300	5.500	4.600 <T	4.700 <T
OCT	4.200 <T	4.100 <T	4.800 <T	4.300 <T
DEC	2.400 <T	1.600 <T	1.500 <T	1.900 <T
URANIUM (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 100 (A1)
FEB	.290 <T	.290 <T	.360 <T	.330 <T
APR	.270 <T	.290 <T	.300 <T	.300 <T
JUN	.250 <T	.340 <T	.330 <T	.320 <T
AUG	.300 <T	.300 <T	.290 <T	.280 <T
OCT	.330 <T	.320 <T	.290 <T	.290 <T
DEC	.340 <T	.290 <T	.260 <T	.300 <T
VANADIUM (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = N/A
FEB	.310 <T	.890	.560	.600
APR	.250 <T	.250 <T	.270 <T	.270 <T
JUN	.090 <T	BDL	.080 <T	.110 <T
AUG	.280 <T	.210 <T	.250 <T	.220 <T
OCT	.270 <T	.280 <T	.290 <T	.320 <T
DEC	.200 <T	.130 <T	.120 <T	.080 <T
ZINC (UG/L)			DET'N LIMIT = 0.20	GUIDELINE = 5000 (A3)
FEB	3.600	1.900 <T	11.000	2.100
APR	3.200	1.800 <T	15.000	2.700
JUN	2.800	2.000 <T	8.800	2.900
AUG	4.300	1.800 <T	9.200	2.700
OCT	2.900	1.500 <T	8.500	3.000
DEC	3.300	3.300	10.000	2.700

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM KINGSTON WTP 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 2	
			STANDING	FREE FLOW
PESTICIDES & PCB				
ALPHA BHC (NG/L)			**DET'N LIMIT = 1.000**	**GUIDELINE = 700 (G)**
FEB	BDL	BDL	.	1.000 <T
APR	!QU	!QU	.	!QU
JUN	1.000 <T	1.000 <T	.	1.000 <T
AUG	1.000 <T	1.000 <T	.	1.000 <T
OCT	BDL	BDL	.	BDL
DEC	BDL	BDL	.	BDL
LINDANE (NG/L)			**DET'N LIMIT = 1.000**	**GUIDELINE = 4000 (A1)**
FEB	BDL	1.000 <T	.	BDL
APR	!QU	!QU	.	!QU
JUN	BDL	BDL	.	BDL
AUG	BDL	BDL	.	BDL
OCT	BDL	BDL	.	BDL
DEC	BDL	BDL	.	BDL
ATRAZINE (NG/L)			**DET'N LIMIT = 50**	**GUIDELINE = 60000 (A2)**
FEB	BDL	BDL	.	.
APR	BDL	BDL	.	.
JUN	410.000 <T	BDL	.	.
AUG	BDL	BDL	.	.
OCT	BDL	BDL	.	.
DEC	BDL	BDL	.	.
DESETHYLATRAZINE (NG/L)			**DET'N LIMIT = 200.0**	**GUIDELINE = 60000 (A2)**
FEB	BDL	BDL	.	.
APR	BDL	BDL	.	.
JUN	2580.000	BDL	.	.
AUG	BDL	BDL	.	.
OCT	BDL	BDL	.	.
DEC	BDL	BDL	.	.

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM KINGSTON WTP 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM		
	RAW	TREATED	SITE 2		
			STANDING	FREE FLOW	
PHENOLICS (UG/L)	PHENOLICS		DET'N LIMIT = .200	GUIDELINE = 2	(A4)
FEB	.400 <T	.600 <T	.	.	
APR	1.000	.800 <T	.	.	
JUN	BDL	BDL	.	.	
AUG	.600 <T	.600 <T	.	.	
OCT	.400 <T	.400 <T	.	.	
DEC	.600 <T	.600 <T	.	.	

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM KINGSTON WTP 1990

	WATER TREATMENT PLANT			DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 2		
			STANDING	FREE FLOW	
VOLATILES					
BENZENE (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 5 (A1)	
FEB	BDL	BDL	.	BDL	
APR	!NR	.050 <T	.	BDL	
JUN	BDL	BDL	.	BDL	
AUG	BDL	BDL	.	BDL	
OCT	BDL	BDL	.	BDL	
DEC	BDL	BDL	.	BDL	
TOLUENE (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 24 (A3)	
FEB	BDL	BDL	.	BDL	
APR	!NR	.050 <T	.	BDL	
JUN	BDL	BDL	.	BDL	
AUG	BDL	BDL	.	BDL	
OCT	BDL	BDL	.	BDL	
DEC	BDL	BDL	.	BDL	
ETHYLBENZENE (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 2.4 (A3)	
FEB	BDL	BDL	.	BDL	
APR	!NR	BDL	.	.050 <T	
JUN	.050 <T	.050 <T	.	.100 <T	
AUG	.100 <T	.100 <T	.	.150 <T	
OCT	BDL	BDL	.	BDL	
DEC	.050 <T	.100 <T	.	.050 <T	
STYRENE (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 100 (D1)	
FEB	BDL	BDL	.	BDL	
APR	!NR	BDL	.	BDL	
JUN	.150 <T	.050 <T	.	.150 <T	
AUG	.300 <T	.050 <T	.	.350 <T	
OCT	BDL	.050 <T	.	BDL	
DEC	.150 <T	.100 <T	.	.100 <T	
CHLOROFORM (UG/L)			DET'N LIMIT = 0.10	GUIDELINE = 350 (A1+)	
FEB	BDL	27.500	.	15.200	
APR	!NR	19.700	.	12.900	
JUN	BDL	24.600	.	13.900	
AUG	BDL	21.600	.	15.500	
OCT	BDL	13.000	.	12.500	
DEC	BDL	10.400	.	6.800	
DICHLOROBROMOMETHANE (UG/L)			DET'N LIMIT = 0.05	GUIDELINE = 350 (A1+)	
FEB	BDL	9.800	.	8.600	
APR	!NR	11.300	.	9.000	
JUN	BDL	10.750	.	8.650	
AUG	BDL	13.300	.	10.550	
OCT	BDL	9.800	.	9.650	
DEC	BDL	9.100	.	7.100	

TABLE 5
DRINKING WATER SURVEILLANCE PROGRAM KINGSTON WTP 1990

	WATER TREATMENT PLANT		DISTRIBUTION SYSTEM	
	RAW	TREATED	SITE 2	
			STANDING	FREE FLOW
CHLORODIBROMOMETHANE (UG/L)		DET'N LIMIT = 0.10		GUIDELINE = 350 (A1+)
FEB	BDL	1.600	.	2.600
APR	!NR	3.600	.	2.800
JUN	BDL	2.900	.	3.200
AUG	BDL	4.800	.	4.500
OCT	BDL	4.600	.	4.700
DEC	BDL	4.300	.	4.000
BROMOFORM (UG/L)		DET'N LIMIT = 0.20		GUIDELINE = 350 (A1+)
FEB	BDL	BDL	.	.200 <T
APR	!NR	BDL	.	BDL
JUN	BDL	BDL	.	.400 <T
AUG	BDL	.400 <T	.	.400 <T
OCT	BDL	.400 <T	.	.400 <T
DEC	BDL	.600 <T	.	.600 <T
TOTL TRIHALOMETHANES (UG/L)		DET'N LIMIT = 0.50		GUIDELINE = 350 (A1)
FEB	BDL	38.850	.	26.600
APR	!NR	34.600	.	24.700
JUN	BDL	38.250	.	26.050
AUG	BDL	40.100	.	31.050
OCT	BDL	27.750	.	27.300
DEC	BDL	24.350	.	18.400

TRACE LEVELS OF TOLUENE ARE LABORATORY ARTIFACTS DERIVED FROM THE ANALYTICAL METHODOLOGY.

TRACE LEVELS OF STYRENE ARE CONSIDERED TO BE LABORATORY ARTIFACTS RESULTING FROM THE LABORATORY SHIPPING CONTAINERS.

TABLE 6
DRINKING WATER SURVEILLANCE PROGRAM 1990

SCAN/PARAMETER	UNIT	DETECTION LIMIT	GUIDELINE
BACTERIOLOGICAL			
FECAL COLIFORM MEMBRANE FILTRATION	CT/100ML	0	0 (A1)
STANDARD PLATE COUNT MEMBRANE FILT.	CT/ML	0	500/ML (A3)
TOTAL COLIFORM BACKGROUND MF	CT/100ML	0	N/A
TOTAL COLIFORM MEMBRANE FILTRATION	CT/100ML	0	5/100ML (A1)
CHEMISTRY (FLD)			
FIELD COMBINED CHLORINE RESIDUAL	MG/L	0	N/A
FIELD TOTAL CHLORINE RESIDUAL	MG/L	0	N/A
FIELD FREE CHLORINE RESIDUAL	MG/L	0	N/A
FIELD PH	DMNSLESS	N/A	6.5-8.5 (A3)
FIELD TEMPERATURE	DEG.C	N/A	15.0 (A3)
FIELD TURBIDITY	FTU	N/A	1.0 (A1)
CHEMISTRY (LAB)			
ALKALINITY	MG/L	0.2	30-500 (A3)
AMMONIUM TOTAL	MG/L	0.002	0.05 (F2)
CALCIUM	MG/L	0.2	100 (F2)
CHLORIDE	MG/L	0.2	250 (A3)
COLOUR	TCU	0.5	5.0 (A3)
CONDUCTIVITY	UMHO/CM	1.0	400 (F2)
CYANIDE	MG/L	0.001	0.2 (A1)
DISSOLVED ORGANIC CARBON	MG/L	0.1	5.0 (A3)
FLUORIDE	MG/L	0.01	2.4 (A1)
HARDNESS	MG/L	0.5	80-100 (A4)
LANGELIERS INDEX	DMNSLESS	N/A	N/A
MAGNESIUM	MG/L	0.1	30.0 (F2)
NITRITE	MG/L	0.001	1.0 (A1)
NITROGEN TOTAL KJELDAHL	MG/L	0.02	N/A
PH	DMNSLESS	N/A	6.5-8.5 (A4)
PHOSPHORUS FIL REACT	MG/L	0.0005	N/A
PHOSPHORUS TOTAL	MG/L	0.002	0.4 (F2)
SODIUM	MG/L	0.2	200 (A4)
SULPHATE	MG/L	0.2	500 (A3)
TOTAL NITRATES	MG/L	0.005	10.0 (A1)
TURBIDITY	FTU	0.05	1.0 (A1)
CHLOROAROMATICS			
123 TRICHLOROBENZENE	NG/L	5.0	N/A
1234 TETRACHLOROBENZENE	NG/L	1.0	N/A
1235 TETRACHLOROBENZENE	NG/L	1.0	N/A
124 TRICHLOROBENZENE	NG/L	5.0	10000 (I)
1245-TETRACHLOROBENZENE	NG/L	1.0	38000 (D4)
135 TRICHLOROBENZENE	NG/L	5.0	N/A
236 TRICHLOROTOLUENE	NG/L	5.0	N/A
245 TRICHLOROTOLUENE	NG/L	5.0	N/A
26A TRICHLOROTOLUENE	NG/L	5.0	N/A
HEXACHLOROBENZENE	NG/L	1.0	10 (C1)
HEXACHLOROBUTADIENE	NG/L	1.0	450 (D4)
HEXACHLOROCYCLOPENTADIENE	NG/L	5.0	206000 (D4)
HEXACHLOROETHANE	NG/L	1.0	1900 (D4)
OCTACHLOROSTYRENE	NG/L	1.0	N/A
PENTACHLOROBENZENE	NG/L	1.0	74000 (D4)
CHLOROPHENOLS			
234 TRICHLOROPHENOL	NG/L	100.0	N/A
2345 TETRACHLOROPHENOL	NG/L	20.0	N/A
2356 TETRACHLOROPHENOL	NG/L	10.0	N/A

TABLE 6
DRINKING WATER SURVEILLANCE PROGRAM 1990

SCAN/PARAMETER	UNIT	DETECTION LIMIT	GUIDELINE
245 TRICHLOROPHENOL	NG/L	100.0	2600000 (D4)
246 TRICHLOROPHENOL	NG/L	20.0	5000 (A1)
PENTACHLOROPHENOL	NG/L	10.0	60000 (A1)
METALS			
ALUMINUM	UG/L	0.10	100 (A4)
ANTIMONY	UG/L	0.05	146 (D4)
ARSENIC	UG/L	0.10	25 (A1)
BARIUM	UG/L	0.05	1000 (A2)
BERYLLIUM	UG/L	0.05	6800 (D4)
BORON	UG/L	2.00	5000 (A1)
CADMIUM	UG/L	0.05	5 (A1)
CHROMIUM	UG/L	0.50	50 (A1)
COBALT	UG/L	0.02	N/A
COPPER	UG/L	0.50	1000 (A3)
IRON	UG/L	6.00	300 (A3)
LEAD	UG/L	0.05	10 (A1)
MANGANESE	UG/L	0.05	50 (A3)
MERCURY	UG/L	0.02	1 (A1)
MOLYBDENUM	UG/L	0.05	N/A
NICKEL	UG/L	0.20	350 (D3)
SELENIUM	UG/L	1.00	10 (A1)
SILVER	UG/L	0.05	50 (A1)
STRONTIUM	UG/L	0.10	N/A
THALLIUM	UG/L	0.05	13 (D4)
TITANIUM	UG/L	0.50	N/A
URANIUM	UG/L	0.05	100 (A1)
VANADIUM	UG/L	0.05	N/A
ZINC	UG/L	0.20	5000 (A3)
PAH			
ANTHRACENE	NG/L	1.0	N/A
BENZO(A) ANTHRACENE	NG/L	20.0	N/A
BENZO(A) PYRENE	NG/L	5.0	10.0 (A1)
BENZO(B) CHRYSENE	NG/L	2.0	N/A
BENZO(B) FLUORANTHENE	NG/L	10.0	N/A
BENZO(E) PYRENE	NG/L	50.0	N/A
BENZO(G,H,I) PERYLENE	NG/L	20.0	N/A
BENZO(K) FLUORANTHENE	NG/L	1.0	N/A
CHRYSENE	NG/L	50.0	N/A
CORONENE	NG/L	10.0	N/A
DIBENZO(A,H) ANTHRACENE	NG/L	10.0	N/A
DIMETHYL BENZO(A) ANTHRACENE	NG/L	5.0	N/A
FLUORANTHENE	NG/L	20.0	42000.0 (D4)
INDENO(1,2,3-C,D) PYRENE	NG/L	20.0	N/A
PERYLENE	NG/L	10.0	N/A
PHENANTHRENE	NG/L	10.0	N/A
PYRENE	NG/L	20.0	N/A
PESTICIDES & PCB			
ALACHLOR (LASSO)	NG/L	500.0	5000 (A2)
ALDRIN	NG/L	1.0	700 (A1)
ALPHA HEXACHLOROCYCLOHEXANE (BHC)	NG/L	1.0	700 (G)
ALPHA CHLORDANE	NG/L	2.0	7000 (A1)
AMETRINE	NG/L	50.0	300000 (D3)
ATRATONE	NG/L	50.0	N/A
ATRAZINE	NG/L	50.0	60000 (A2)
DES ETHYL ATRAZINE	NG/L	200.0	60000 (A2)
BETA HEXACHLOROCYCLOHEXANE (BHC)	NG/L	1.0	300 (G)
CYANAZINE (BLADEX)	NG/L	100.0	10000 (A2)
O,P-DDD	NG/L	5.0	10 (I)
DIELDRIN	NG/L	2.0	700 (A1)
ENDOSULFAN 1 (THIODAN I)	NG/L	2.0	74000 (D4)
ENDOSULFAN 2 (THIODAN II)	NG/L	5.0	74000 (D4)

TABLE 6
DRINKING WATER SURVEILLANCE PROGRAM 1990

SCAN/PARAMETER	UNIT	DETECTION LIMIT	GUIDELINE
ENDOSULFAN SULPHATE (THIODAN SULPHATE)	NG/L	5.0	N/A
ENDRIN	NG/L	5.0	1600 (D3)
GAMMA CHLORDANE	NG/L	2.0	7000 (A1)
HEPTACHLOR	NG/L	1.0	3000 (A1)
HEPTACHLOR EPOXIDE	NG/L	1.0	3000 (A1)
LINDANE (GAMMA BHC)	NG/L	1.0	4000 (A1)
METHOXYCHLOR	NG/L	5.0	900000 (A1)
METOLACHLOR	NG/L	500.0	50000 (A2)
METRIBUZIN (SENCOR)	NG/L	100.0	80000 (A1)
MIREX	NG/L	5.0	N/A
P,P-DDD	NG/L	5.0	N/A
O,P-DDT	NG/L	5.0	30000 (A1)
OXYCHLORDANE	NG/L	2.0	N/A
PCB	NG/L	20.0	3000 (A2)
PPDDE	NG/L	1.0	30000 (A1)
PPDDT	NG/L	5.0	30000 (A1)
PROMETONE	NG/L	50.0	52500 (D3)
PROMETRYNE	NG/L	50.0	1000 (A2)
PROPAZINE	NG/L	50.0	700000 (D3)
SIMAZINE	NG/L	50.0	10000 (A2)
D-ETHYL SIMAZINE	NG/L	200.0	10000 (A2)
TOXAPHENE	NG/L	500.0	5000 (A1)
PHENOLICS			
PHENOLICS (UNFILTERED REACTIVE)	UG/L	0.2	2 (A4)
SPECIFIC PESTICIDES			
2,4 D PROPIONIC ACID	NG/L	100.	N/A
2,4,5-TRICHLOROPHENOXY ACETIC ACID	NG/L	50.	280000 (A1)
2,4-DICHLOROBUTYRIC ACID (2,4-D)	NG/L	100.	100000 (A1)
24-DICHLORORPHENOXYBUTYRIC ACID (24-DB)	NG/L	200.	18000 (B3)
BUTYLATE (SUTAN)	NG/L	2000.	245000 (D3)
CARBARYL (SEVIN)	NG/L	200.	90000 (A1)
CARBOFURAN	NG/L	2000.	90000 (A1)
CHLORPYRIFOS (DURSBAN)	NG/L	20.	N/A
CICP (CHLORPROPHAM)	NG/L	2000.	350000 (G)
DIALLATE	NG/L	2000.	N/A
DIAZINON	NG/L	20.	20000 (A1)
DICAMBA	NG/L	50.	120000 (A1)
DICHLOROVOS	NG/L	20.	N/A
EPTAM	NG/L	2000.	N/A
ETHION	NG/L	20.	35000 (G)
IPC	NG/L	2000.	N/A
MALATHION	NG/L	20.	190000 (A1)
METHYL PARATHION	NG/L	50.	7000 (B3)
METHYLTRITHION	NG/L	20.	N/A
MEVINPHOS	NG/L	20.	N/A
PARATHION	NG/L	20.	50000 (A1)
PHORATE (THIMET)	NG/L	20.	2000 (A2)
PROPOXUR (BAYGON)	NG/L	2000.	140000 (D3)
RELDAN	NG/L	20.	N/A
RONNEL	NG/L	20.	N/A
SILVEX (2,4,5-TP)	NG/L	20.	10000 (A1)
VOLATILES			
1,1 DICHLOROETHANE	UG/L	0.10	N/A
1,1 DICHLOROETHYLENE	UG/L	0.10	7 (D1)
1,2 DICHLOROBENZENE	UG/L	0.05	200 (A1)
1,2 DICHLOROETHANE	UG/L	0.05	5 (A1)

TABLE 6
DRINKING WATER SURVEILLANCE PROGRAM 1990

SCAN/PARAMETER	UNIT	DETECTION LIMIT	GUIDELINE	
1,2 DICHLOROPROPANE	UG/L	0.05	5	(D1)
1,3 DICHLOROBENZENE	UG/L	0.10	3750	(D3)
1,4 DICHLOROBENZENE	UG/L	0.10	5	(A1)
111, TRICHLOROETHANE	UG/L	0.02	200	(D1)
112 TRICHLOROETHANE	UG/L	0.05	0.6	(D4)
1122 TETRACHLOROETHANE	UG/L	0.05	0.17	(D4)
BENZENE	UG/L	0.05	5	(A1)
BROMOFORM	UG/L	0.20	350	(A1+)
CARBON TETRACHLORIDE	UG/L	0.20	5	(A1)
CHLOROBENZENE	UG/L	0.10	1510	(D3)
CHLORODIBROMOMETHANE	UG/L	0.10	350	(A1+)
CHLOROFORM	UG/L	0.10	350	(A1+)
DICHLOROBROMOMETHANE	UG/L	0.05	350	(A1+)
ETHLYENE DIBROMIDE	UG/L	0.05	50	(D1)
ETHYLBENZENE	UG/L	0.05	2.4	(A3)
M-XYLENE	UG/L	0.10	300	(A3*)
METHYLENE CHLORIDE	UG/L	0.50	50	(A1)
O-XYLENE	UG/L	0.05	300	(A3*)
P-XYLENE	UG/L	0.10	300	(A3*)
STYRENE	UG/L	0.05	100	(D1)
TETRACHLOROETHYLENE	UG/L	0.05	5	(D1)
TRANS 1,2 DICHLOROETHYLENE	UG/L	0.10	70	(D1)
TOLUENE	UG/L	0.05	24	(A3)
TOTAL TRIHALOMETHANES	UG/L	0.50	350	(A1)
TRICHLOROETHYLENE	UG/L	0.10	50	(A1)

Appendix A

DRINKING WATER SURVEILLANCE PROGRAM
PROGRAM DESCRIPTION

The Drinking Water Surveillance Program (DWSP) for Ontario monitors drinking water quality at municipal water supply systems. The DWSP Database Management System provides a computerized drinking water quality information system for the supplies monitored. The objectives of the program are to provide:

- immediate, reliable, current information on drinking water quality;
- a flagging mechanism for guideline exceedance;
- a definition of contaminant levels and trends;
- a comprehensive background for remedial action;
- a framework for assessment of new contaminants; and
- an indication of treatment efficiency of plant processes.

PROGRAM

The DWSP officially began in April 1986 and is designed to eventually include all municipal water supplies in Ontario. In 1990, 76 systems were being monitored. Water supply locations have been prioritized for surveillance based primarily on criteria such as population density, probability of contamination and geographical location.

An ongoing assessment of future monitoring requirements at each location will be made. Monitoring will continue at the initial locations at an appropriate level and further locations will be phased into the program as resources permit.

A major goal of the program is to collect valid water quality data in context with plant operational characteristics at the time of sampling. As soon as sufficient data have been accumulated and analyzed, both the frequency of sampling and the range of parameters may be adjusted accordingly.

Assessments are carried out at all locations prior to initial sampling, in order to acquire complete plant process and distribution system details and to designate (and retrofit if necessary) all sampling systems and locations. This ensures that the sampled water is a reflection of the water itself.

Samples are taken of raw (ambient water) and treated water at the treatment plant and of consumer's tap water in the distribution system. In order to determine possible effects of distribution on water quality, both standing and free flow water in old and new sections of the distribution system are sampled. Sampling is carried out by operational personnel who have been trained in applicable procedures.

Comprehensive standardized procedures and field test kits are supplied to sampling personnel. This ensures that samples are taken and handled according to standard protocols and that field testing will supply reliable data. All field and laboratory analyses are carried out using "approved documented procedures". Most laboratory analyses are carried out by the Ministry of Environment (MOE), Laboratory Services Branch. Radionuclides are analyzed by the Ministry of Labour.

DATA REPORTING MECHANISM

When the analytical results are transferred from the MOE laboratory into the DWSP system, printouts of the completed analyses are sent to the MOE District Officer, the appropriate operational staff and are also retained by the DWSP unit.

PROGRAM INPUTS AND OUTPUTS

There are four major inputs and four major outputs in the program.

Program Input - Plant and Distribution System Description

The system description includes plant specific non-analytical information acquired through a questionnaire and an initial plant visit. During the initial assessment of the plant and distribution system, questionnaire content is verified and missing information added. It is intended that all data be kept current with scheduled annual updates.

The Plant and Distribution System Description consists of the following seven components:

1. PROCESS COMPONENT INVENTORY
All physical and chemical processes to which the water is subjected, from the intake pipe to the consumers' tap (where possible), are documented. These include: process type, general description of physical structures, material types, sizes, and retention time for each process within the plant. The processes may be as simple as transmission or as complex as carbon adsorption.

2. TREATMENT CHEMICALS
Chemicals used in the treatment processes, their function, application point, supplier and brand-name are recorded. Chemical dosages applied on the day of sampling are recorded in DWSP.

3. PROCESS CONTROL MEASUREMENTS
Documentation of in-plant monitoring of process parameters (eg. turbidity, chlorine residuals, pH, aluminum residuals) including methods used, monitoring locations and frequency is contained in this section. Except for the recorded Field Data, in-plant monitoring results are not retained in DWSP but are retained by the water treatment plant personnel.

4. DESIGN FLOW AND RETENTION TIME

Hydraulic capacity, designed and actual, is noted here. Retention time (the time that a block of water is retained in the plant) is also noted. Maximum, minimum and average flow, as well as a record of the flow rate on the day of sampling, are recorded in DWSP.

5. DISTRIBUTION SYSTEM DESCRIPTION

This area includes the storage and transmission characteristics of the distribution system after the water leaves the plant.

6. SAMPLING SYSTEM

Each plant is assessed for its adequacy in terms of the sampling of bacteriological, organic and inorganic parameters. Prime considerations in the assessment and design of the sampling system are:

i/ the sample is an accurate representation of the actual water condition, eg. raw water has had no chemical treatment;

ii/ the water being sampled is not being modified by the sampling system;

iii/ the sample tap must be in a clean area of the plant, preferably a lab area; and

iv/ the sample lines must be organically inert (no plastic, ideally stainless steel).

It is imperative that the sampled water be a reflection not of the sampling system but of the water itself.

The sampling system documentation includes: origin of the water; date sampling was initiated; size, length and material type (intake, discharge and tap); pump characteristics (model, type, capacity); and flow rate.

7. PERSONNEL

This section contains the names, addresses and phone numbers of current plant management and operational staff, distribution system management and operational staff, Medical Officer of Health and appropriate MOE personnel associated with the plant.

Program Input - Field Data

The second major input to DWSP is field data. Field data is collected at the plant and from the distribution system sites on the day of sampling. Field data consists of general operating conditions and the results of testing for field parameters. General operating conditions include chemicals used, dosages, flow and retention time on the day of sampling, as well as, monthly maximum, minimum and average flows. Field parameters include turbidity, chlorine residuals (free, combined and total), temperature and pH. These parameters are analyzed according to standardized DWSP protocols to allow for interplant comparison.

Program Input - Laboratory Analytical Data

The third major input to DWSP is Laboratory Analytical Data. Samples gathered from the raw, treated and distribution sampling sites are analyzed for the presence of approximately 180 parameters at a frequency of two to twelve times per year. Sixty-five percent of the parameters are organic. Parameters measured may have health or aesthetic implications when present in drinking water. Many of the parameters may be used in the treatment process or may be treatment by-products. Due to the nature of certain analytical instruments, parameters may be measured in a "scan" producing some results for parameters that are not on the DWSP priority list, but which may be of interest. The majority of parameters are measured on a routine basis. Those that are technically more difficult and/or costly to analyze, however, are done less frequently. These include Specific Pesticides and Chlorophenols.

Although the parameter list is extensive, additional parameters with the potential to cause health or aesthetic related problems may be added provided reliable analytical and sampling methods exist.

All laboratory generated data is derived from standardized, documented analytical protocols. The analytical method is an integral part of the data and as methods change, notation will be made and comparison data documented.

Program Input - Parameter Reference Information

The fourth major input to DWSP is Parameter Reference Information. This is a catalogue of information for each substance analyzed on DWSP. It includes parameter name and aliases, physical and chemical properties, basic toxicology, world-wide health limits, treatment methods and uses. The Parameter Reference Information is computerized and can be accessed through the Query function of the DWSP database. An example is shown in figure 1.

Program output - Query

All DWSP information is easily accessed through the Query function, therefore, anything from addresses of plant personnel to complete water quality information for a plant's water supply is instantly available. The DWSP computer system makes relatively complex inquiries manageable. A personal password allowing access into the DWSP query mode in all MOE offices is being developed by the DWSP group.

Program Output - Action Alerts

Drinking Water quality in Ontario is evaluated against provincial objectives as outlined in the Ontario Drinking Water Objectives publication. Should the reported level of a substance in treated water exceed the Ontario Drinking Water Objective, an "Action Alert" requiring

resampling and confirmation is issued. This assures that operational staff, health authorities and the public are notified as soon as possible of the confirmation of an exceedance and remedial action taken. This report supplies a history of the occurrence of past exceedances at the plant plus a historical summary on the parameter of concern.

In the absence of Ontario Drinking Water Objectives, guidelines/limits from other agencies are used. The Parameter Listing System, published by MOE (ISBN 0-7729-4461-X), catalogues and keeps current guidelines for 650 parameters from agencies throughout the world. If these guidelines are exceeded, the results are flagged and evaluated by DWSP personnel. An "Action Alert" will be issued if warranted.

Program Output - Report Generation

Custom reports can be generated from DWSP to meet MOE Regional needs and to respond to public requests.

Program Output - Annual Reports

It is the practice of DWSP to produce an annual report containing analytical data along with companion plant information.

FIG.1

MOE - DRINKING WATER ASSESSMENT PROGRAM (DWSP)

PARAMETER REFERENCE INFORMATION

BENZENE (B2001P) VOLATILES

CLASS: HEALTH METHOD: P0C0D0 UNIT: µg/L

SOURCE	FROM	TO	METHOD	GUIDELINE	UNIT	NOTE
CAL C	85/01			0.700	µg/L	AL
CDWG C	87/01			5.000	µg/L	MAC
EPA C	87/07			5.000	µg/L	MCL
EPAA C	80/11			6.600	µg/L	AMBIENT **
FERC C	84/05			1.000	µg/L	MCL
WHO C	84/01			10.000	µg/L	GV

DESCRIPTION:**NAME:** BENZENE
CAS#: 71-43-2
MOLECULAR FORMULAE: C_6H_6
DETECTION LIMIT: (FOR METHOD POCODO) 0.05 µg/L
SYNONYMS: BENZOL; BENZOLE; COAL NAPHTHA; CARBON OIL (27). CYCLOHEXATRIENE (41).
CHARACTERISTICS: COLOURLESS TO LIGHT-YELLOW, MOBILE, NON-POLAR LIQUID, OF HIGHLY REFRACTIVE NATURE, AROMATIC ODOUR; VAPOURS BURN WITH SMOKING FLAME (30).
PROPERTIES: SOLUBILITY IN WATER: 1780-1800 mg/L AT 25C (41). THRESHOLD ODOUR: 0.5 - 10 PPM IN WATERTHRESHOLD TASTE: 0.5 mg/L IN WATER (39).
ENVIRONMENTAL FATE: MAY BIOACCUMULATE IN LIVING ORGANISMS AND APPEARS TO ACCUMULATE IN ANIMAL TISSUES THAT EXHIBIT A HIGH LIPID CONTENT OR REPRESENT MAJOR METABOLIC SITES, SUCH AS LIVER OR BRAIN; SMALL QUANTITIES EVAPORATE FROM SOILS OR ARE DEGRADED RATHER QUICKLY (80).
SOURCES: COMMERCIAL: PETROLEUM REFINING; SOLVENT RECOVERY; COAL TAR DISTILLATION (39); FOOD PROCESSING AND TANNING INDUSTRIES; COMBUSTION OF CAR EXHAUST.
ENVIRONMENTAL: POSSIBLE SOURCE IS RUNOFF.
USES: DETERGENTS; NYLON; INTERMEDIATE IN PRODUCTION OF OTHER COMPOUNDS, SUCH AS PESTICIDES; SOLVENT FOR EXTRACTION AND RECTIFICATION IN RUBBER INDUSTRY; DEGREASING AND CLEANSING AGENT; GASOLINE.

TOXICITY: RATING: 4 (VERY TOXIC).
ACUTE: IRRITATING TO MUCOUS MEMBRANES; SYMPTOMS INCLUDE RESTLESSNESS, CONVULSIONS, EXCITEMENT,

DEPRESSION; DEATH MAY FOLLOW RESPIRATORY FAILURE.
CHRONIC: MAY CAUSE ANAEMIA AND LEUKAEMIA (45); MUTAGENIC.
MODE OF ACTION: CHROMOABERRATION IN LYMPHOCYTE CULTURES.

CARCINOGENICITY: A KNOWN HUMAN CARCINOGEN.

REMOVAL: THE FOLLOWING PROCESSES HAVE BEEN SUCCESSFUL IN REMOVING BENZENE FROM WASTEWATER: GAC ADSORPTION, PRECIPITATION WITH ALUM AND SUBSEQUENT REMOVAL VIA SEDIMENTATION, COAGULATION AND FLOCCULATION, SOLVENT EXTRACTION, OXIDATION

ADDITIONAL PROPERTIES:

MOLECULAR WEIGHT: 78.12
MELTING POINT: 5.5°C (27).
BOILING POINT: 80.1°C (27).
SPECIFIC GRAVITY: 0.8790 AT 20°C (27).
VAPOUR PRESSURE: 100 MM AT 26.1°C (27).
HENRY'S LAW CONSTANT: 0.00555 ATM-M3/MOLE (41).
LOG OCT./WATER PARTITION COEFFICIENT: 1.95 TO 2.13 (39).
CARBON ADSORPTION: K=1.0; 1/N=1.6; R=0.97; PH=5.3 (41)SEDIMENT/WATER PARTITION COEFFICIENT: NO DATA

NOTES: EPA PRIORITY POLLUTANT.

Appendix B

DWSP SAMPLING GUIDELINE

i) Raw and Treated at Plant

General Chemistry	-500 mL plastic bottle (PET 500) -rinse bottle and cap with sample water three times -fill to 2 cm from top
Bacteriological	-220 mL plastic bottle with white seal on cap -do <u>not</u> rinse bottle, preservative has been added -avoid touching bottle neck or inside of cap -fill to top of red label as marked
Metals	-500 mL plastic bottle (PET 500) -rinse bottle and cap three times -fill to 2 cm from top -add 10 drops nitric acid (HNO_3) (**Caution:** HNO_3 is corrosive)
Volatiles (duplicates) (OPOPUP)	-45 mL glass vial with septum (teflon side must be in contact with sample) -do <u>not</u> rinse bottle -fill bottle completely without bubbles
Organics (OWOC),(OWTRI),(OAPAHX)	-1 L amber glass bottle per scan -do <u>not</u> rinse bottle -fill to 2 cm from top -when 'special pesticides' are requested three extra bottles must be filled
Cyanide	-500 mL plastic bottle (PET 500) -rinse bottle and cap three times -fill to 2 cm from top -add 10 drops sodium hydroxide (NaOH) (**Caution:** NaOH is corrosive)
Mercury	-250 mL glass bottle -rinse bottle and cap three times -fill to top of label -add 20 drops each nitric acid (HNO_3) and potassium dichromate ($K_2Cr_2O_7$) (**Caution:** HNO_3&$K_2Cr_2O_7$ are corrosive)

Phenols	-250 mL glass bottle -do not rinse bottle, preservative has been added -fill to top of label
Radionuclides (as scheduled)	-4 L plastic jug -do not rinse, carrier added -fill to 5 cm from top
Organic Characterization (GC/MS - once per year)	-1 L amber glass bottle; instructions as per organic -250 mL glass bottle -do not rinse bottle -fill completely without bubbles

Steps:

1. Let sampling water tap run for an adequate time to clear the sample line.

2. Record time of day on submission sheet.

3. Record temperature on submission sheet.

4. Fill up all bottles as per instructions.

5. Record chlorine residuals (free, combined and total for treated water only), turbidity and pH on submission sheet.

ii) Distribution Samples (standing water)

General Chemistry	-500 mL plastic bottle (PET 500) -rinse bottle and cap with sample water three times -fill to 2 cm from top
Metals	-500 mL plastic bottle (PET 500) -rinse bottle and cap three times -fill to 2 cm from top -add 10 drops nitric acid (HNO_3) (**Caution:** HNO_3 is corrosive)

Steps:

1. Record time of day on submission sheet.
2. Place bucket under tap and open cold water.
3. Fill to predetermined volume.
4. After mixing the water, record the temperature on the submission sheet.
5. Fill general chemistry and metals bottles.
6. Record chlorine residuals (free, combined and total), turbidity and pH on submission sheet.

iii) Distribution Samples (free flow)

General Chemistry	-500 mL plastic bottle (PET 500) -rinse bottle and cap with sample water three times -fill to 2 cm from top
Bacteriological	-250 mL plastic bottle with white seal on cap -do not rinse bottle, preservative has been added -avoid touching bottle neck or inside of cap -fill to top of red label as marked
Metals	-500 mL plastic bottle (PET 500) -rinse bottle and cap three times -fill to 2 cm from top -add 10 drops nitric acid HNO_3 (**Caution:** HNO_3 is corrosive)
Volatiles (duplicate) (OPOPUP)	-45 mL glass vial with septum (teflon side must be in contact with sample) -do not rinse bottle, preservative has been added -fill bottle completely without bubbles

Organics (OWOC) (OAPAHX)	-1 L amber glass bottle per scan -do <u>not</u> rinse bottle -fill to 2 cm from top

<u>Steps:</u>

1. Record time of day on submission sheet.
2. Let cold water flow for five minutes.
3. Record temperature on submission sheet.
4. Fill all bottles as per instructions.
5. Record chlorine residuals (free, combined and total), turbidity and pH on submission sheet.